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Research Article

Examination of the change in Assessment of Motor and Process Skills performance in patients with acquired brain injury between the hospital and home environment

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Aim: *The Assessment of Motor and Process Skills (AMPS) is a standardised, valid, reliable, observational assessment that is sensitive to change over time. This research aimed to examine the change in AMPS performance in patients discharged from a neurosurgical rehabilitation ward to a home-based therapy programme over a four-week time frame.*

Methods: *A total of 15 individuals with acquired brain injury who were participating in rehabilitation were recruited to the study. The AMPS was conducted with each individual during the participant's inpatient rehabilitation and again approximately four weeks later, while participating in home-based rehabilitation. Assessment results were collated using the AMPS computer programme and entered into a statistics package from which data were analysed.*

Results: *As a group, no statistically significant change in function was identified between the home and hospital environments; however, individual results did indicate a change in occupational performance for many of the participants.*

Conclusions: *The AMPS was shown to reflect a change in occupational performance for many of the research participants. This research supports previous studies which indicate that some individuals' motor and process skill abilities appear to be affected by the environment in which they perform. This suggests that occupational therapists wishing to know how an individual will perform activities of daily living should evaluate the individual's performance in the environment in which they will be functioning.*

KEY WORDS *activities of daily living, assessment, brain injury, environment, rehabilitation service.*

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Introduction

Acquired brain injury (ABI) refers to any type of brain damage that occurs after birth. It can include damage sustained by infection, disease, lack of oxygen or a blow to the head (Ponsford, Sloan & Snow, 1995). The long-term effects of brain injury are difficult to predict, as they will be different for each person and can range from mild to severe. In addition to the potential physical deficits, it is common for many people with ABI to experience increased fatigue (mental and physical); impaired perception; deficits of attention, speed of information processing, learning, memory and executive function; reduced initiative; inflexible thought processes; and impairment of the ability to control and monitor thoughts and behaviour (Gillen, 2009). These problems affect an individual's capacity to perform many of the activities that are necessary and relevant in daily life.

Occupational therapists have a major role in brain injury rehabilitation, including assessing patients' ability to perform activities of daily living (ADL) safely and independently in the home environment (Darragh, Sample & Fisher, 1998). Individuals who have suffered an ABI often experience difficulties in performing both personal ADL (PADL) such as bathing, dressing and grooming, and instrumental ADL (IADL), which refers to domestic tasks such as meal preparation, cleaning and shopping. It is acknowledged that brain injury rehabilitation is an extensive process, involving a period of inpatient rehabilitation followed by further rehabilitation within the home and community environment (Radomski, 2008).

Currently, limited evidence is available to guide assessment choice for occupational therapists providing rehabilitation to individuals with brain injury in the home and community, with few standardised, functional assessments being applicable to both settings. The role of the OT working in the home and community is to assist patients to maximise their independence and safety in performing ADLs through functional retraining. Examples of intervention include addressing the skills required to achieve meal preparation, shopping, cleaning the home and self-care. Each patient has very different functional goals; therefore, the challenge for the OT is to find an assessment tool that has scope to cover the variety of activities that a person may wish to perform in the home and community setting.

Selected assessment tools must reflect current conceptual frameworks used in our practice such as the International Classification of Functioning, Disability and Health (ICF; World Health Organisation, 2001). The ICF classifies health and health-related domains that describe body functions and structures, activities and participation. It defines a person's functioning as a dynamic interaction between their health condition and environmental and personal factors. Many functional assessments used in the rehabilitation setting focus on the ICF 'activity' level of performance, such as the Functional Independence Measure (FIM; Guide for the Uniform Data Set for Medical Rehabilitation, 1999) and the Modified Barthel Index (MBI; Shah, Vanclay & Cooper, 1989). In contrast, the Assessment of Motor and Process Skills (AMPS) is a performance evaluation and provides a greater amount of information at an ICF 'participation' level.

The AMPS was developed from the recognition that occupational therapists obtain important information about a person's abilities and limitations by observing the person in the context of performing real-life tasks that are meaningful and familiar. Client abilities can be assessed and compared over time, in alternative settings and using different tasks (Fisher, 2003). The AMPS is based on a model of rehabilitation that focuses on the analysis of performance through occupation and the use of adaptation during interventions.

The AMPS is a standardised, valid (Bernspang & Fisher, 1995; Duran & Fisher, 1996; Girard, Fisher, Short & Duran, 1999), reliable (Bernspang, 1999; Law, Baum & Dunn, 2001), observational assessment that is sensitive to change over time (Law *et al.*; Bjorkdahl, Lundgren, Nilsson, Grimby & Stibrant Sunnerhagen, 2006). It is useful with clients aged three or older, with any diagnosis or disability. It assesses the quality of a person's performance by rating them according to the efficiency, effectiveness, safety and independence demonstrated during the evaluation (Fisher, 2003). Published studies support the validity of the AMPS across different cultures (Bernspang & Fisher), between genders (Duran & Fisher) and with different diagnostic subgroups (Bernspang & Fisher; Girard *et al.*).

The AMPS evaluates the quality of 16 motor and 20 process skills while the client performs IADL or PADL in the manner in which he or she normally performs them. ADL motor skills are the observable goal-directed actions the person enacts during the performance of ADL tasks to move oneself or the task objects. They are grouped under sub-headings of posture, mobility, coordination, strength and effort, and energy. ADL process skills are the observable actions of performance the person enacts to logically sequence the actions of the ADL task performance over time, select and use appropriate tools and materials and adapt performance when problems are encountered. These skills are grouped under sub-headings of energy, using knowledge, temporal organisation, space and objects and adaptation (Fisher, 2003).

Several studies have investigated the use of the AMPS with ABI subjects. Waehrens and Fisher (2007) investigated the quality of ADL performance among 36 people with ABI in an inpatient rehabilitation setting. They utilised a retrospective pre- and post-test design, with no control group for patients receiving interdisciplinary intervention that incorporated restorative and compensatory strategies. The AMPS identified improvements across all ages and with no relation to time post-injury. Linden, Boschian, Eker, Schalen and Nordstrom (2005) compared the use of the AMPS with neuropsychological testing for predicting the ability to resume independent living for patients with ABI. A total of 16 patients were evaluated at regular intervals, with results showing that the AMPS gave a different view to neuropsychological testing and concluded that it may be a better predictor of a patient's ability to live an independent life.

Several studies have investigated the use of the AMPS to determine the effect of the environment on functional performance. Darragh *et al.* (1998) compared the performance of 20 individuals with ABI who had been living in the community for a minimum of one year. The participants were assessed using the AMPS in their familiar home environment and in the unfamiliar clinic setting. They concluded that individuals with ABI may be influenced by their environment when performing ADLs. Investigating the effect of the environment on functional performance has also been pursued with subjects presenting with other diagnostic conditions. Nygard, Bernspang, Fisher and Winblad (1994) used the AMPS to investigate ADL ability in the home and clinic environments for 19 participants with suspected dementia who attended an outpatient memory clinic. Results found no overall difference in their ADL motor or process performance between the two settings. In a similar study design, Park, Fisher and Velozo (1994) compared AMPS results between the home and clinic for 20 community-living older adults with various non-acute medical conditions. Results suggested that process skill abilities were affected by the environment to a greater degree than motor skill abilities.

The objective of our study was to examine the change in AMPS performance in patients with ABI who were discharged from a neurosurgical rehabilitation ward to a home-based therapy programme over a four-week time frame. We were also interested to determine if functional performance in the home would be enhanced in comparison with that in the hospital environment.

Methods

Approval was obtained from the Royal Perth hospital Human Ethics Committee to conduct this pilot study. Recruitment began in May 2005 for a predetermined sample size of 15. Participants were recruited during their inpatient admission to the neurosurgical rehabilitation ward. The ward therapists were responsible for screening consecutive participants according to inclusion and exclusion criteria.

The inclusion criteria included:

- Neurosurgery inpatients with a diagnosis of ABI inclusive of traumatic brain injury (TBI), subarachnoid haemorrhage (SAH), intracranial haemorrhage (ICH) and hypoxic brain injury;
- Age 18–65 years;
- Requiring home-based occupational therapy rehabilitation following discharge for identified home/community ADL goals;
- Referred to and accepted by the RITH (Rehabilitation In The Home) programme.

Exclusion criteria included:

- Impairments in receptive language;
- English as a second language;
- Diagnosed with antibiotic-resistant organisms, and hence prevented from accessing functional assessment areas within the hospital setting;
- Discharged to an unfamiliar home environment.

Once consent was obtained from eligible participants the participants were provided with a study information sheet. Demographic information, including diagnosis, age, gender and the presence of co-existing conditions, was collected from the participants' medical records. Date of injury, rehabilitation admission and discharge dates and RITH admission and discharge dates were also collected to provide a time line of rehabilitation.

Instruments

Each participant was assessed by trained and calibrated AMPS assessors using the AMPS during the last week of their inpatient admission. The therapist assisted each participant to select two tasks from a variety of pre-established PADLs and IADLs that were relevant and meaningful to them. The therapist then observed the participant while he/she performed the selected tasks in the Functional Training Unit of the Occupational Therapy Department. This wheelchair-accessible unit consists of a kitchen, bedroom and laundry. Using a four-point scale, the therapist rated the participant's performance on 16 ADL motor and 20 ADL process skills.

The activities undertaken ranged in difficulty level from easy tasks, such as obtaining a beverage from the refrigerator, to much harder than average tasks, such as preparing fried rice. The unique design of the AMPS allows the OT to compare the ability of a client in performing one set of tasks upon initial evaluation with the results of performance on a different set of tasks upon re-evaluation (Fisher, 2003). As such, the tasks undertaken in both environments were not necessarily the same; however, they were selected to provide an appropriate level of challenge for each participant.

The standard RITH programme involves multidisciplinary treatment of patients in their home environments for three to four weeks immediately following discharge from hospital. These sessions (approximately two to three per week) focussed on pre-established functional goals. The follow-up AMPS assessment was conducted in the final week of the participant's RITH intervention; therefore, the re-test time frame was approximately four weeks for all participants. The follow-up assessment was conducted by the AMPS assessor in the participant's home environment. Staff conducting the AMPS did not remain consistent between the participants and setting. However, as the AMPS scores are corrected for rater severity, a change in rater should not have affected the outcome (Fisher, 2003; Lunz & Stahl, 1990).

Scoring and statistical analysis

While observing participant performance, the assessors scored each of the 36 motor and process skills on a four-point scale: 1, markedly deficient; 2, ineffective; 3, questionable; and 4, competent, according to the AMPS skill descriptors. The raw scores were entered into the AMPS computer programme, version 2005. Using Rasch analysis, the AMPS programme was then able to convert a person's ordinal raw AMPS skill item score into a linear continuum, which was reported in logits (log-odds probability units) according to the level of participant skill, the level of challenge inherent in the task and the pre-measured assessor severity. Logits data were entered in the SPSS statistical data package (SPSS, 2006), where initial and repeat motor and process skill measures were compared and averaged. Paired sample *t*-tests were undertaken with differences between scores, with a probability of $P < 0.05$ being considered statistically significant.

Results

A total of 15 participants were recruited over a 19-month period. Of the participants, 47% (7) suffered an SAH, 27% (4) a TBI, 20% (3) had an ICH and 7% (1) had a hypoxic brain injury. The group was comprised of 40% (6) male and 60% (9) female participants with a mean age of 42.8 years. The mean time between brain injury and initial assessment in the week preceding inpatient discharge was 113 days (range 37–301 days). These participants had significant limitations in functional performance on admission to hospital, requiring a lengthy inpatient rehabilitation programme. Each participant had deficits affecting some or all areas of motor, cognitive, psychosocial and perceptual performance.

Table 1 presents AMPS motor and process scores at both evaluation 1 (preceding hospital discharge) and evaluation 2 (in the participant's home). Mean motor scores decreased from x = 1.848 logits at evaluation 1, to 1.596 logits at evaluation 2. Process scores increased from x = 1.013 logits at evaluation 1, to 1.081 logits at evaluation 2. Paired t-tests (Table 2) did not identify these differences to be statistically significant for either the AMPS motor scores (t = 0.963, P = 0.352) or for the AMPS process scores (t = −0.257, P = 0.801). For both motor and process scores, the 95% confidence interval of the difference includes zero, which suggests that there is no statistically significant difference between the evaluations.

The AMPS allows participants' ADL motor and process measures to be plotted against the AMPS scale cut-off values of 2.0 or less logits for motor measures and 1.0 or less logits for process measures. Measures below these cut-off values (as shown in Fig. 1) indicate the presence of difficulties that impacted on the effectiveness or quality of task performance (Fisher, 2003). Eight participants scored below the cut-off value for motor skills on initial assessment and twelve on reassessment. Eight participants scored below the cut-off value for initial process scores and seven on reassessment.

TABLE 1: *Paired samples statistics: Hospital and home scores*

	Mean (logits)	n	SD	95% confidence interval
AMPS motor score				
Hospital assessment	1.848	15	1.237	1.163–2.533
Home assessment	1.596	15	1.382	0.831–2.361
AMPS process score				
Hospital assessment	1.013	15	0.528	0.721–1.305
Home assessment	1.081	15	0.870	0.599–1.563

AMPS, Assessment of Motor and Process Skills; SD, standard deviation.

The motor and process measures are reported in log-odd probability units (logits).

An additional cut-off risk zone of ±0.3 logits has been identified, which relates to an individual's potential to live independently in the community. Four participants were assessed within or above this zone for both motor and process skills. Eight participants were in this range for only motor performance and nine for process performance.

Table 3 highlights the respective motor and process scores of the 15 participants from initial assessment to reassessment. Of the 15 participants, 11 scored lower on either the motor or the process scale at home compared with that in hospital. According to the AMPS manual, a change in score of greater than 0.5 logits between evaluation 1 and evaluation 2 on either the AMPS motor or process skill scale indicates a clinically relevant change in occupational performance. A change of 0.3 or 0.4 logits in reassessment may not be statistically significant, but may still be clinically meaningful in terms of a change in occupational performance (Fisher, 2003). It can be seen in Table 3 that a change in occupational performance (>0.3 logits) occurred for 13 participants with regard to motor scores and for 12 participants for process scores.

Discussion

As a group, no statistically significant change between hospital and home was identified using paired t-tests and analysis of confidence intervals. However, in reviewing the results for each individual, as seen in Table 3, it is clear that there has been a change in occupational performance for many of the participants between the initial and repeat AMPS assessments.

The ICF embraces the relationship between the person and the context in which daily living occurs, and therefore includes environmental factors as part of the classification system (Gillen, 2009). It is interesting to note that many participants scored lower at home than in the hospital environment. Assessments were introduced, discussed and conducted with patients in the home setting in the same way as had been in the hospital environment, with tasks at an appropriate level of challenge. Some participants appeared more relaxed in their home

TABLE 2: *Paired sample t-test: Hospital and home scores*

	Mean (logits)	SD	t	Significance (two-tailed)	95% confidence interval
AMPS motor score, hospital and home assessments	0.252	1.014	0.963	0.352	−0.310–0.814
AMPS process score, hospital and home assessments	−0.068	1.024	−0.257	0.801	−0.635–0.499

AMPS, Assessment of Motor and Process Skills; SD, standard deviation.

The motor and process measures are reported in log-odd probability units (logits).

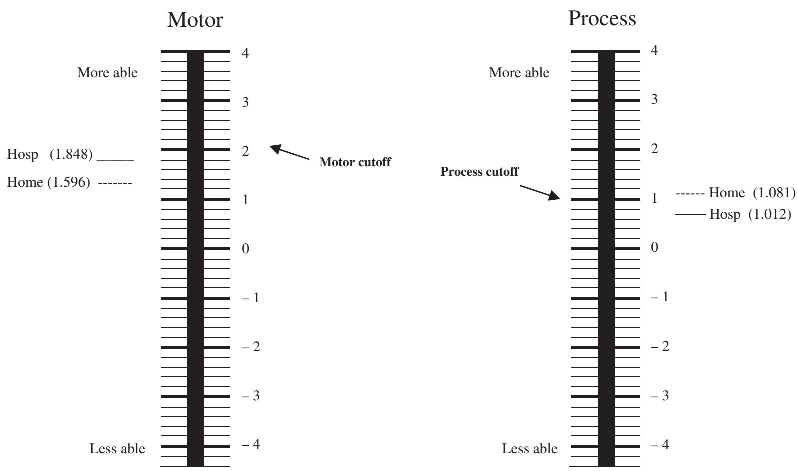

FIGURE 1: *Graphic report: Mean hospital and home scores. The activities of daily living (ADL) motor and ADL process measures are plotted in relation to the Assessment of Motor and Process Skills scale cut-off values. Measures below these cut-off values indicate that there were problems that impacted the quality or effectiveness of ADL task performance. The ADL motor and ADL process measures are reported in log-odd probability units (logits) of ADL ability.*

TABLE 3: *Hospital and home Assessment of Motor and Process Skill (AMPS) scores for each participant*

Participant	AMPS motor score at hospital	AMPS motor score at home	Difference in AMPS motor score between hospital and home assessments	AMPS process score at hospital	AMPS process score at home	Difference in AMPS process score between hospital and home assessments
1	2.26	1.74	−0.52	0.90	1.44	0.54
2	1.24	1.07	−0.17	1.70	1.51	−0.19
3	2.57	1.86	−0.71	1.04	1.24	0.2
4	2.74	3.36	0.62	0.77	0.24	−0.53
5	−0.38	−2.33	−1.95	0.66	−0.35	−1.01
6	3.20	2.00	−1.20	1.30	0.34	−0.96
7	3.39	2.99	−0.40	1.35	0.36	−0.99
8	1.14	0.54	−0.60	1.91	1.42	−0.49
9	1.12	1.42	0.30	1.31	2.55	1.24
10	1.98	3.60	1.62	0.41	2.93	2.52
11	2.96	1.88	−1.08	0.99	1.34	0.35
12	1.61	1.67	0.06	0.82	0.49	−0.33
13	−0.21	0.98	1.19	0.54	0.8	0.26
14	3.42	1.80	−1.62	1.58	0.63	−0.95
15	0.68	1.36	0.68	−0.08	1.28	1.36

The motor and process measures are reported in log-odd probability units (logits).

environment and did not appear to be aware of their own body postures and positioning in relation to the task and environment. Examples include persistently propping on a counter or leaning to talk to the examiner; ineffective positioning too far away from the workspace; and ineffective lifting and transporting skills, such as sliding objects across the counter vs. carrying them. Skill items such as 'positions', 'reaches' and 'bends' scored lower at home for most participants, resulting in an overall lower motor skill score. One participant had a cluttered home, which impeded task progress. Another participant had progressed from wheelchair usage in hospital and was assessed attempting to walk in the home environment, which impacted on all their motor skill scores.

Many participants at home appeared distracted by the examiner and stopped to engage in general conversation, which impacted on process skill items such as 'attends', 'paces', 'initiates' and 'continues'. It is possible that fatigue may have affected performance as overall daily demands may have increased once the participant was home, compared with the structured clinical setting. However, there were no obvious signs of fatigue observed or reported.

The AMPS was conducted with participants at home four to five weeks post-hospital discharge. The AMPS tasks chosen were those the participants had been familiar with prior to their injury. The average inpatient length of stay was 113 days, indicating that the participants had a considerable amount of time functioning in the safe and controlled hospital environment. For some participants, the home setting may have been less familiar than the hospital environment when discharged. Participants may have had less time to practice and master tasks at home with their residual deficits than they had had in hospital. This may have contributed to lower AMPS score in the home setting.

Increased time between assessments may have produced more definitive results, as individuals would have had more time to adapt to the changes in living environment. The environment can promote orientation and efficient functioning by providing structure and cues, or it can create confusion and inefficient functioning because of unfamiliarity, unexpected stressors and distractions (Darragh *et al*., 1998). Home environments tend to have more clutter inherently and are not generally designed for disabled access. The current study supports previous studies that have suggested that some individuals' motor and process skill abilities appear to be affected by the environment in which they perform. Nygard *et al.* (1994) also reported in their study comparing the performance of participants with diagnosed or suspected dementia at home and in the clinic using the AMPS that there was no overall significant difference as a group in IADL motor or process performance between the two settings. This is despite speculation that functional performance would be improved in a familiar setting. However, some individual participants' performance did differ significantly between the two environments. Nygard *et al.* hypothesised that procedural memory may not be specific to environment but rather to actions and tasks routinely performed.

It was anticipated that process skills of this ABI population would have been more affected between settings, whereas they remained fairly constant. Motor skill scores decreased in the home setting compared with that in the hospital environment, which differs from many other studies. The study of ABI patients by Linden *et al.* (2005) found that 11 of 13 participants deteriorated in process skills after leaving the rehabilitation centre. It was proposed that the participants may not have made the necessary cognitive adaptations to the new setting, the home environment.

Darragh *et al.* (1998) also found that individuals with ABI perform IADL tasks better overall in the familiar home setting than in unfamiliar settings with regard to process skills. Their study demonstrated a significant mean difference in AMPS IADL process ability and no significant difference in AMPS IADL motor ability. However, it is noted that 50% of participants in their study were five years or more post-injury, and many of the participants had been living in their home for a considerable time post-hospital discharge and so were very familiar with their home environment. In contrast, participants in the current study had been discharged home only four to five weeks previously from long stays in a controlled hospital environment. They were only beginning the transition phase from hospital to community and, therefore, were possibly still adapting to their residual deficits and learning alternative ways of functioning.

The study by Park *et al.* (1994) also found no significant difference between mean home and clinic IADL motor ability measures in their study examining the effect of home vs. clinic settings on the IADL performance of older adults with various medical conditions. However, individual ability measures revealed that three participants performed much better in the home, whereas one participant performed much better in the clinic. They also found a significant difference between mean home and clinic IADL process measures in 10 of the 20 participants who performed significantly better in the home environment. Once again, the participants of the study were community dwelling and not familiar with the clinic setting.

The clinical question arising from the research is: How well does assessment by occupational therapists in the hospital enable them to make a reasonably accurate prediction of a person's performance in the home environment? The current study tends to support Darragh *et al*.'s (1998) comment that if results from clinic assessments are used to predict home performance, the results may indicate a more skilled performance than would perhaps be found in the now possibly unfamiliar home environment. The implication of this is that occupational therapists cannot be completely confident that their clinic evaluations are accurate indicators of an individual's ability to perform in an unfamiliar home environment, particularly if they have had a prolonged hospital admission and complex changes in physical and cognitive functions. Many studies support the use of natural context (e.g. environment) to facilitate performance (Ma, Trombly & Robinson-Podolski, 1999). It may be more beneficial to discharge patients home earlier in the rehabilitation continuum, with more extensive home-based therapy to practice mastering IADLs in the home environment.

Conclusion

As a group, there was no statistically significant change in AMPS assessment scores between the home and hospital environment. However, in reviewing individual participants, the AMPS did identify changes in occupational performance over a four-week time period. This study did not meet the clinical assumption that performance at home would be better than that in the hospital environment. For many of the participants, the home environment may have become the 'unfamiliar environment' because of their prolonged hospitalisation. This study supports the view that if occupational therapists wish to know how an individual will perform his/her ADLs, they should evaluate the individual's performance in the environment in which they will be functioning. It may also be suggested that treatment should be provided in the individual's familiar environment, as opposed to a clinical setting, as ABI patients have difficulty transferring skills between environments. It may, therefore, be beneficial to discharge a person home earlier from the hospital setting and increase the frequency and duration of rehabilitation in the home and community environment. Potential future research could assess patients after a longer period at home to determine if greater familiarity with the home environment contributes to improved AMPS scores and associated functional abilities.

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